

We claim:

1. A valve driving device for an engine comprising,  
a camshaft produced by casting and formed with one center cam and two side cams which are different from the center cam in lift amount, with the center cam being centrally located between the side cams in an axial direction of the camshaft,  
a tappet assembly slidably fitted in a tappet guide hole formed in the engine and abutting on one of the center cam and the side cams to drive a valve, and including a center tappet adapted to abut on the center cam and side tappets adapted to abut on the side cams,  
the center tappet being slidably connected to the side tappets in a sliding direction of the tappet,  
one of the center tappet and the side tappets being connected to a valve shaft of the valve,  
a lock mechanism which selectively locks or unlocks the center tappet and the side tappets with or from each other so that the tappet assembly is driven by the center cam when the lock mechanism locks the center tappet and the side tappets with each other and the tappet assembly is driven by the side cams when the lock mechanism unlocks the center tappet and the side tappets from each other,  
wherein one cam of the center cam and the side cams is dimensioned so that a cam portion thereof over a predetermined angle range except for a cam nose section thereof is smaller than a base circle of the other cam in profile.
2. The valve driving device for an engine as defined in claim 1, further comprising a depression formed over the predetermined angle range except for the cam nose section of the one cam, said depression being depressed from the base circle of the one cam so as to be substantially the same as a shaft section of the camshaft in profile.
3. The valve driving device for an engine as defined in claim 2, wherein the two side cams are identical in cam profile and lower than the center cam in lift amount, and the one cam is the center cam.
4. The valve driving device for an engine as defined in any one of claims 1, wherein the portion over the predetermined angle range is left as-cast.
5. The valve driving device for an engine as defined in claim 1, further comprising a lost-motion spring biasing the center tappet towards the center cam in the tappet assembly,

wherein the side tappet includes a limiting portion which limits the displacement of the center tappet against the biasing force of the lost-motion spring so as to prohibit an abutting surface of the center tappet on the center cam from shifting beyond abutting surfaces of the side tappets on the side cams.

6. The valve driving device for an engine as defined in claim 5, wherein the lock mechanism includes a hydraulic piston and a lock pin received in bushings fitted in through holes formed in the center tappet and the side tappets, the lock pin being driven by the hydraulic piston,

wherein the bushing in the side tappet protrudes towards the center tappet so as to abut on the center tappet to limit the displacement of the center tappet.

7. The valve driving device for an engine as defined in claim 1, wherein the side tappets are connected with each other via a connecting portion provided at the ends opposite to the abutting surfaces to form substantially U-shape when viewed in a direction perpendicular to the sliding direction of the tappet and in the direction perpendicular to the axial direction of the camshaft,

the connecting portion abuts on the valve shaft, and

the tappet assembly is in substantially circle shape formed by the center tappet and the side tappet when viewed in the sliding direction of the tappet.

8. The valve driving device for an engine as defined in claim 7, wherein the center tappet is in substantially rectangular shape elongated in the direction perpendicular to the axial direction of the camshaft when viewed in the sliding direction of the tappet,

projections are formed at both end surfaces of the center tappet with respect to the direction perpendicular to the axial direction of the camshaft and perpendicular to the sliding direction of the tappet, so as to project towards the side tappets,

inner surfaces of the projections form sliding surfaces which extend in the sliding direction of the tappet and slidably contact with the side tappets,

the side tappets are in substantially bicornate shape when viewed in the sliding direction of the tappet, and

sliding surfaces are formed at both ends of the side tappets with respect to the direction perpendicular to the axial direction of the camshaft and perpendicular to the sliding direction of the tappet, so as to extend in the axial direction of the camshaft and in the sliding direction of the tappet and to slidably contact with the inner surfaces of the projections.

9. A valve driving device for an engine comprising,

a camshaft produced by casting and formed with one center cam and two side cams which are lower than the center cam in lift amount and identical in cam profile, with the center cam being centrally located between the side cams in an axial direction of the camshaft,

a tappet assembly slidably fitted in a tappet guide hole formed in the engine while abutting on one of the center cam and the side cams to drive a valve, and including a center tappet adapted to abut on the center cam and side tappets adapted to abut on the side cams,

the tappet assembly being in substantially circle shape formed by the center tappet and the side tappets when viewed in the sliding direction of the tappet,

the side tappets being connected with each other via a connecting portion provided at the ends opposite to abutting surfaces to form substantially U-shape when viewed in the direction perpendicular to the sliding direction of the tappet and in the direction perpendicular to the axial direction of the camshaft,

the side tappet being coupled to a valve shaft of the valve at the connecting portion,

the center tappet being slidably connected to the side tappets in a sliding direction of the tappet,

a lock mechanism which selectively locks or unlocks the center tappet and the side tappets with or from each other so that the tappet assembly is driven by the center cam when the lock mechanism locks the center tappet and the side tappets with each other and the tappet assembly is driven by the side cams when the lock mechanism unlocks the center tappet and the side tappets from each other,

wherein a depression is formed over a predetermined angle range except for a cam nose section of the center cam, said depression being depressed from a base circle of the center cam so as to be substantially the same as a shaft section of the camshaft in profile.